

REMARKS

Reconsideration of this application is respectfully requested.

Claims 24 through 31 are pending in the application with claims 24 and 31 having been amended. Entry of these amendments is respectfully requested as it is believed they place the application in condition for allowance or in better condition for appeal.

The specification has been amended at the points indicated to correct errors of a clerical or typographical nature. It is submitted that these amendments introduce no new matter into the application and their entry is respectfully requested.

Submitted herewith is a Second Request for Approval of Proposed Drawing Corrections as required by the Examiner to correct the arrow of the exhaust gas 7.

Claims 24-31 have been rejected under 35 U.S.C. 112, first and second paragraphs, because, according to the Examiner, the claimed invention is not described in such full, clear, concise, and exact terms as to enable any person skilled in the art to make and use the same, and/or for failing to particularly point out and distinctly claim the subject matter that Applicants regard as their invention. Specifically, according to the Examiner: "In claim 24, it is

unclear what is required by 'at least aluminum and nickel as metallic components', the aluminum and nickel are required to be in metallic form or they are required to be in oxide form even though they are themselves 'metals'. If the former is true, it is unclear if the metallic form can hydrolyze the fluorine compound because all the exemplified catalysts in the instant specification are in oxide form. Also, the dependent claims 25-27 would fail to further limit claim 24 because these dependent claims require oxides of aluminum and nickel."

Claim 24 has now been amended to require that the aluminum and nickel be present as metallic components in the form of single oxides or composite oxides. Accordingly, it is submitted that this ground of rejection has been overcome and its withdrawal is respectfully requested.

Claims 24-31 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicants regard as their invention. Specifically, according to the Examiner, in claim 24, "showing a higher decomposition activity" is indefinite because it is unclear "higher" as opposed to what.

Claim 24 has been amended by deletion of the word "higher". Accordingly, it is submitted that this ground of

rejection has been overcome and its withdrawal is respectfully requested.

Regarding the amendments to the claims, the compounds consisting of carbon and fluorine; carbon, hydrogen, and fluorine; and carbon, hydrogen, oxygen, and fluorine are supported in the specification on page 8, at lines 12 through 18, as well as elsewhere.

The catalyst in the form of single oxides or composite oxides is supported in the specification on page 10 at lines 7 through 9.

The reaction with steam and oxygen is supported in the specification on page 8, line 26 to page 9, line 8, page 13, lines 11 through 17, and elsewhere. The reaction gas comprising steam and oxygen is supported in the specification on page 29, lines 10-12 (air is disclosed), page 13, lines 11-12, page 42, lines 1-3 (Example 14 refers to Example 13).

Decomposing in place of hydrolyzing is supported on page 5, line 1, and page 13, line 18.

The generation of carbon dioxide is supported on page 9, line 8, and page 13, line 17.

Claims 24-28 and 31 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Lercher et al. (U.S. Patent No. 5,710,359).

Claims 29-30 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Lercher et al. in view of Rosenbaum (U.S. Patent No. 5,460,792).

Claims 24-28 and 31 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Greene (U.S. Patent No. 5,414,201).

Claims 29-30 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Greene in view of Rosenbaum.

Lercher et al. disclose a process for the environmentally appropriate degradation of chemical compounds which have one or more heteroatoms X, with X being F, Cl, Br, I, N, O or S, by cleavage of the C--X carbon-heteroatom bonds, characterized in that the chemical compounds or articles which contain the chemical compounds are treated with water vapor in the presence of an aluminum catalyst at 300E-600E C.

Rosenbaum discloses a process for the removal and destruction of organic compounds in liquid and gaseous streams by complete oxidation of the organic compounds in the presence of a carbonaceous catalyst at temperatures below about 400E C. The process involves removal of organic compounds in a regeneration step from adsorbents containing organic compounds adsorbed thereon, in which the organic compounds have been previously removed from contaminated fluid streams in an adsorption step, and destruction of the contaminants in an

oxidative destruction step by contacting the organic compounds with a carbonaceous catalyst in the presence of oxygen. The process involving oxidation catalysts optionally doped with transition metal oxides is said to be particularly useful for the complete destruction of volatile organic chemicals found in contaminated groundwaters.

Greene discloses a process and a sorbent/catalyst composition for the oxidation of volatile organic compounds. The process uses the steps of adsorbing a volatile organic compound in a first segment of a sorbent/catalyst bed at an adsorption temperature, followed by sequential heating of an opposed second segment of a sorbent/catalyst bed, downstream of the first segment, from an initial temperature to an oxidation temperature, desorbing the volatile organic compound from the first segment of the bed by heating, and cooling of the first and second segments of the bed respectively. The sorbent/catalyst contains an adsorption segment, e.g., metal oxides, unexchanged zeolites, carbon and polymeric resins, etc., and a catalytic segment for the subsequent catalytic oxidation of the compounds. The catalyst can be a metal-exchanged aluminosilicate zeolite having at least one exchanged metal, a metal-impregnated aluminosilicate zeolite having at least one impregnated metal, or a metal-exchanged, metal-impregnated aluminosilicate zeolite having at least one

exchanged metal and at least one impregnated metal. Both the exchanged and impregnated metals are selected from the group consisting of Ti, V, Cr, Co, Ni, Cu, Fe, Mo, Mn, Pt and Pd.

Lercher et al. disclose a process for the degradation of a triazine or melamine-formaldehyde resin having C!X bonds by cleavage of the C!X bonds using water vapor in the presence of an aluminum catalyst (see claim 1, etc.)

The Examiner alleges in the Office Action (page 4, lines 7-8) that the C!F bond as disclosed in Lercher fairly suggests that C!F compounds, such as CF₄, C₂F₆, etc., can be degraded by the Lercher process, but such an allegation seems to be derived from distortion or neglect of the object of the invention of Lercher disclosed in column 1, lines 37-49, wherein complete disposal for a *multiplicity of different compounds having carbon-heteroatom bonds* is aimed at, and a *great variety of compounds having carbon-beteroatom bonds* can be degraded in an environmentally appropriate manner.

According to the claims of the present application, as now amended, the reaction mechanism of the present invention and the catalyst used therein are clearly different from those of Lercher.

(A) Reaction Mechanism.

In the present invention, a fluorine compound or compounds, such as a compound consisting of carbon and fluorine, is reacted with steam and oxygen using a catalyst, such as alumina and nickel oxide, to decompose the fluorine compound to hydrogen fluoride and carbon dioxide.

In contrast, according to Lercher et al., a great variety of compounds having C!X bonds are treated with water vapor (steam) using an aluminum catalyst. Oxygen is not used as a reactant. Further Lercher et al. do not disclose or suggest the idea of decomposing only fluorine compounds, such as a compound consisting of carbon and fluorine, as in the present invention.

According to Lercher et al., air can be used as a carrier gas (column 4, lines 34-35), but they have no intention of using the air as a reactant, since the air is used in the context of inert gases, such as helium, argon, and nitrogen.

(B) Catalyst

As the aluminum catalyst, Lercher et al. disclose various aluminum compounds and additional metals in column 3, lines 10-29, but, in the working examples, the use of a catalyst containing aluminum and nickel (oxide form) is nowhere disclosed.

Further, as the inert support, silicon, aluminum, aluminum silicate, and ceramic oxides are disclosed (column 3,

lines 21-23), but when silicon or aluminum silicate are used, such a support is changed to SiF_4 , and thus consumed, when CF_4 , C_2F_6 , etc., gas is used as a reactant. This is a matter of course, since a fluorine compound, such as CF_4 , C_2F_6 , etc., is typically used as an etching gas for a silicon chip by changing SiO_2 to SiF_4 (in a gas form).

Moreover, as shown in Example 6 and Fig. 6 of the present application, when alumina catalyst 19 is used, the decomposition rate of C_2F_6 is as low as about 40% or more, while, with alumina-nickel oxide catalysts 27 and 28, the decomposition rate is as high as about 95% or more. When Al_2O_3 - SiO_2 catalyst 36 is used, the decomposition rate is also as low as 40%. These data clearly show results that would be unexpected by those skilled in the art from a reading of Lercher et al.

In addition, it is well known to those skilled in the catalyst art that when reactants, reaction conditions, components and compositions of catalysts, etc. are changed, catalytic activity cannot easily be predicted.

The Examiner further alleges that AlOOH fairly suggests boehmite, but this indication is in error. As shown on page 7, line 2 of the specification the present invention, boehmite is used as a starting material for alumina, not as a final catalyst form.

Rosenbaum discloses a process for the destruction of hydrocarbon compounds, e.g., halogenated organic compounds, by oxidizing them using as a catalyst a carbonaceous pyrolyzed resinous polymer doped with metal oxides, etc.

As the halogenated organic compounds, various compounds are exemplified in column 6, lines 19, but compounds containing fluorine are not disclosed. Further, the oxidation temperature is as low as about 150E to 250E C (claim 1) and less than 400E C (column 14, line 48, and the Abstract), which temperature is clearly lower than the 400E to 800E C used in the practice of the present invention.

Additionally, Rosenbaum is silent with regard to any catalyst comprising alumina, nickel oxide, and zinc oxide.

On the other hand, Lercher et al. disclose degradation of chemical compounds having C!X carbon-heteroatom bonds using steam as a reactant. Accordingly, one skilled in the art would not be motivated to combine the teaching of Lercher et al. with that of Rosenbaum, since the reaction disclosed by Rosenbaum is one of oxidation, rather than one employing steam alone, as is the case with Lercher et al.

Further, the use of a catalyst comprising alumina, nickel oxide, and zinc oxide is not taught by Lercher et al., nor by Rosenbaum, and therefore, the combination of Lercher et al.

with Rosenbaum is meaningless to those skilled in the art, since the reaction mechanisms are quite different between the two. According to the present invention, as shown in Example 15, the catalyst $\text{Al}_2\text{O}_3\text{-NiO-ZnO}$ is effective for the decomposition of C_2F_6 when the reaction temperature is 680E or higher, as shown in Figure 13.

Greene discloses oxidation of volatile organic compounds using, as a catalyst, an aluminosilicate zeolite, a part of which is exchanged by an impregnated metal selected from Ti, V, Cr, Mn, Co, Ni, Cu, Fe, Mo, Mn, Pd, and Pt (column 4, lines 46-52).

In contrast, if an aluminosilicate zeolite, as taught by Greene, were to be used in the practice of the present invention, it would be consumed, since such a zeolite would react with the fluorine compound. Thus, Greene's aluminosilicate zeolite could not be used in the process of the present invention.

Further, Greene teaches the use of oxygen for his oxidation. The present invention, on the other hand, employs both oxygen (air) and steam for carrying out the reaction. Thus, the process of amended claim 24, wherein a fluorine compound, i.e., one consisting of carbon and fluorine; carbon, hydrogen, and fluorine; or carbon, hydrogen, oxygen, and fluorine, is reacted with steam and oxygen to be decomposed

into hydrogen fluoride and carbon dioxide, is not disclosed or suggested by Greene.

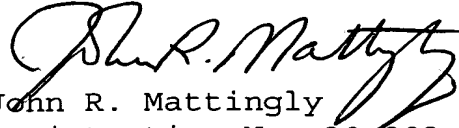
Both Greene and Rosenbaum disclose oxidation, but the method of treatment is quite different from that of present claims 29 and 30, which are dependent upon claim 24 wherein steam and oxygen are used as reactants.

Further, neither Greene nor Rosenbaum disclose the addition of zinc oxide to a catalyst comprising oxides of aluminum and nickel.

Accordingly, none of the cited references, alone or in combination disclose or suggest the invention of the amended claims and it is therefore requested that the rejections of claims 24-28 and 31 under 35 U.S.C. 103(a) as being unpatentable over Lercher et al., claims 29-30 under 35 U.S.C. 103(a) as being unpatentable over Lercher et al. in view of Rosenbaum, claims 24-28 and 31 under 35 U.S.C. 103(a) as being unpatentable over Greene, and claims 29-30 under 35 U.S.C. 103(a) as being unpatentable over Greene in view of Rosenbaum be withdrawn.

In view of the foregoing, it is submitted that this application is now in condition for allowance, and an early Office Action to that end is earnestly solicited.

Respectfully submitted,



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